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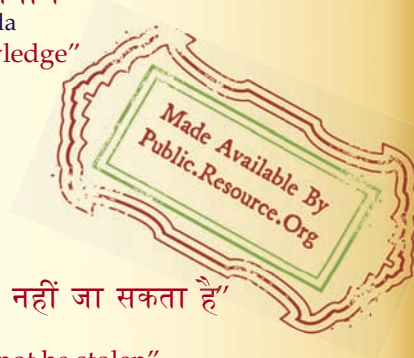
IS 3091 (1999): Aluminium Bronze Ingots and Castings for Overhead Fittings in Electric Traction [MTD 8: Copper and Copper Alloys]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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एल्युमिनियम-कांस्य के इंगत एवं ढलाइयाँ — विशिष्टि

(पहला पुनरीक्षण)

*Indian Standard*

ALUMINIUM BRONZE INGOTS AND CASTINGS  
FOR OVERHEAD FITTINGS IN ELECTRIC  
TRACTION — SPECIFICATION

*(First Revision)*

ICS 77.150-10; 29.280

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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1965. In the present revision following modifications have been made :

- a) A new clause on references has been incorporated.
- b) Requirements of Radiographic examination have been modified.
- c) Amendment No. 1 has been incorporated.

This standard contains clauses **7, 9** and **10** in which purchaser is allowed to exercise his option.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical value (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Indian Standard

## ALUMINIUM BRONZE INGOTS AND CASTINGS FOR OVERHEAD FITTINGS IN ELECTRIC TRACTION — SPECIFICATION

(First Revision)

### 1 SCOPE

This standard covers the requirements of aluminium bronze ingots and castings for overhead fittings used in electric traction.

### 2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
1387:1993	General requirements for the supply of metallurgical materials ( <i>second revision</i> )
1608:1995	Mechanical testing of metals — Tensile testing ( <i>second revision</i> )
2376:1963	Colour code for the identification of copper and copper alloys
2595:1978	Code of practice for radiographic testing ( <i>first revision</i> )
3288	Glossary of terms for copper and copper alloys;
(Part 1):1986	Materials ( <i>third revision</i> )
(Part 2):1986	Unwrought form and cast form
3657:1978	Radiographic image quality indicators ( <i>first revision</i> )
4027:1967	Methods of chemical analysis of bronzes

### 3 TERMINOLOGY

**3.1** For the purpose of this standard, the definition of terms given in IS 3288 (Part 1) and IS 3288 (Part 2) and the following definitions shall apply.

**3.2 Lot** — In any consignment all the ingots/castings of the same class and manufactured at the same place shall be grouped together to constitute a lot.

**3.3 Melt** — The quantity of metal melted in a crucible or a furnace at one time and cast into ingots

or castings. In the case of continuous casting it shall be the quantity cast continuously over a period of 4 hours.

**3.4 Work's Analysis** — The routine analysis carried out by the manufacturer in order to control the quality of material.

### 4 SUPPLY OF MATERIAL

The general requirements relating to the supply of material shall conform to IS 1387.

### 5 CHEMICAL COMPOSITION

Aluminium bronze ingots and castings, when analyzed by the method specified in relevant parts of IS 4027 or any other established instrumental/chemical method shall conform to the requirements as given in Table 1. In case of dispute, the procedure given in IS 4027 and its relevant parts shall be the referee method. However, when the method is not given in IS 4027 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

Table 1 Chemical Composition

SI No.	Constituent	Requirement, Percent
(1)	(2)	(3)
i)	Aluminium	9.0 to 11.0
ii)	Iron	4.0 to 5.0
iii)	Manganese	0.1 to 0.5
iv)	Copper	Balance

### 6 TENSILE PROPERTIES

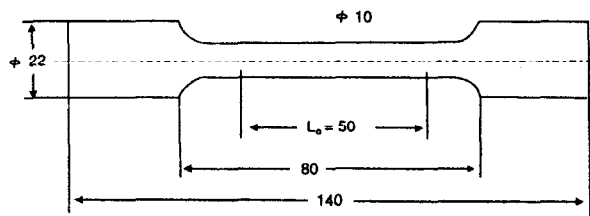
**6.1** Tensile test when carried out as per IS 1608 on cast-to-shape type test pieces shall conform to the requirements given in Table 2.

Table 2 Tensile Properties

SI No.	Tensile Property	Minimum Requirement
(1)	(2)	(3)
i)	0.2 percent permanent set proof stress	250 MPa
ii)	Tensile strength	600 MPa
iii)	Elongation on 50 mm gauge length	20 percent

NOTE — 1 MPa = 1 N/mm<sup>2</sup> = 0.102 kgf/mm<sup>2</sup>.

6.2 The shape and dimensions of cast-to-shape test pieces shall be as given in Fig. 1.



All dimensions in millimetres.

FIG. 1 DIMENSIONS OF CAST-TO-SHAPE TEST PIECE

6.2.1 The material for the test-piece mould shall be the same as that for the moulds of ingots or castings.

## 7 RADIOGRAPHY EXAMINATION OF CASTINGS

7.1 The types of castings to be radiographed and their details shall be specified by the purchaser. Acceptance standard for defects observed in radiographs shall be as given in Table 3.

Table 3 Radiographic Acceptance Standard

Sl No.	Type of Defects	Acceptance Level
(1)	(2)	(3)
i)	Hot tears	Not permitted
ii)	Shrinkage	Not permitted
iii)	Porosity	Pin-hole porosity at isolated locations should be permitted. Clusters of pin-hole porosities should not be permitted. The distance between pin-holes should not be less than 15 mm. Porosity near the edges should not be accepted.
iv)	Inclusions	Inclusions due to dross and foreign material rounded in shape of the size not exceeding 2 mm at one or two places should be permitted.

7.2 Image quality indicators (*see* IS 3657) shall be used for radiography and their sensitivities shall not be less than 2 percent.

7.3 The general guidelines for radiography examination as given in IS 2595 may be followed.

## 8 FREEDOM FROM DEFECTS

### 8.1 Ingots

Ingots shall be of uniform quality and reasonably free from slag, dross and other harmful contaminations.

### 8.2 Castings

Castings shall be clean, sound and free from harmful inclusions. Any casting may subsequently be rejected due to manufacturing defects, notwithstanding the fact that it had been previously passed for chemical composition and mechanical properties.

## 9 REPAIR OF CASTINGS

Any repair, which is to conceal defects, is forbidden. Small superficial defects may be removed with cutter grindstone or file after obtaining specific written permission from the purchaser, so long as it does not harm proper use of the casting, leaving the local dimension within the limits of imposed allowances.

## 10 SHAPES, SIZES AND MASS

### 10.1 Ingots

Aluminium bronze shall be supplied in the form of notched ingots. Unless agreed to between the purchaser and the manufacturer, the mass of ingots shall be  $6 \pm 1$  kg.

### 10.2 Castings

The dimensions of the castings shall be in accordance with the drawing furnished by the purchaser.

## 11 TOLERANCE ON CASTINGS

11.1 Unless specified otherwise on the drawing, casting shall conform to the following tolerances:

Type of Surface	Tolerance in mm
Mating surfaces (unmachined)	
a) Holes	+ 0.5 0
b) Shafts	0 - 0.5
Non-mating surfaces (unmachined)	$\pm 1.0$

11.2 In the case of surfaces to be machined, at least 2 mm machining allowance should be provided.

## 12 MARKING

12.1 Each ingot or casting may suitably be marked with the following details:

- Lot Number,
- Colour code as per IS 2376, and
- Indication of the source of the manufacturer.

12.2 The material may also be marked with the Standard Mark.

12.2.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of the conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 13 SAMPLING

Unless agreed otherwise, the method of drawing representative samples of the material and the criteria for conformity shall be as given in Annex A.

## 14 ORDERING INFORMATION

The purchaser should provide following information at the time of placing the order :

- Whether radiographic examination is required and, if so, what are the details (*see 7*);
- Whether he prefers any special size, shape and mass of the ingots (*see 10.1*);

- The details of drawings of castings (*see 10.2*);
- Whether the general tolerances specified for castings are adequate (*see 11*);
- Marking details (*see 12*); and
- Whether he wishes to inspect the material at the manufacturer's works (*see 13*).

## ANNEX A

(Clause 13)

### SAMPLING AND CRITERIA FOR CONFORMITY

#### A-1 FREEDOM FROM DEFECTS AND SIZE, SHAPE AND MASS

##### A-1.1 Sampling

The number of ingots/castings to be inspected from a lot for freedom from defects (*see 8*) and size, shape and mass (*see 10*) shall be in accordance with col 1 and 2 of Table 4 given below.

**Table 4 Number of Ingots/Castings to be Inspected and Permissible Number of Defectives**

SI No.	No. of Ingots/Castings in the Lot	No. of Ingots/Castings to be Inspected	Permissible Number of Defectives <sup>1)</sup>
(1)	(2)	(3)	(4)
i)	Up to 50	All	+ <sup>2)</sup>
ii)	51 to 150	50	1
iii)	151 to 300	80	2
iv)	301 to 500	125	3
v)	501 and above	200	5

<sup>1)</sup> This ensures that lots containing only one percent defective ingots/castings or less will be accepted most of the times.

<sup>2)</sup> The defectives encountered shall be removed and only the remaining ingots/castings shall be accepted.

##### A-1.2 Criteria for Conformity

The lot shall be considered as conforming to the requirements of this standard, if the number of defectives (those failing to satisfy the requirements given in 8 or 10) is less than or equal to the permissible number given in col 3 of Table 4. In the case of those lots which have been found unsatisfactory according to Table 4, all the ingots/castings may be inspected for freedom from defects and size, shape and mass subject to agreement between the purchaser and the manufacturer.

#### A-2 CHEMICAL COMPOSITION

##### A-2.1 Sampling

Sampling of ingots and castings may be done from each lot as given in Table 5. The ingots or test bars from castings so selected shall be drilled or sawn right through the section. The drill or saw used for taking the samples shall be thoroughly cleaned and no lubricant shall be used in the operation. The drillings or sawings shall be treated with a magnet to remove any ferrous particles introduced while taking the sample. The drillings or sawings after being thoroughly mixed constitute the sample for chemical analysis.

**Table 5 Sampling of Ingots and Castings**

SI No.	Weight of Individual Ingots/Castings	Lot Size
(1)	(2)	(3)
i)	1 kg or less	200 kg or part thereof
ii)	Above 1 kg	500 kg or part thereof

NOTE — A lot shall consist of only one melt.

##### A-2.2 Criteria for Conformity

Should a test piece fail, two further test pieces which represent the same lot may be tested in the same manner. Should one of the further test pieces meet the requirements of specification, the ingots or castings represented thereby shall be deemed to comply with the standard. Should both of these test pieces fail the ingots or castings represented thereby shall be deemed not to comply with the standard.

**A-2.3** The manufacturer shall, when required, supply a copy of his work's analysis of the material.



### **A-3 TENSILE PROPERTIES**

#### **A-3.1 Sampling**

Three cast-to-shape test pieces shall be made from each lot (*see* Table 5) for tensile testing. As agreed to between the purchaser and the manufacturer the test pieces may be made in the presence of purchaser or his representative.

#### **A-3.2 Criteria for Conformity**

If the mechanical properties are met by the first test piece, the lot shall be accepted. If the first test piece fails to conform to the specified requirements, the two remaining test pieces shall be tested; and if either of them fails to meet the specified requirements, the whole lot shall be rejected.

### **A-4 RADIOGRAPHIC EXAMINATION OF CASTINGS**

#### **A-4.1 Sampling**

Two percent of such castings in each lot (*see* Table 5) shall be subjected to radiographic examination for detection of casting defects.

#### **A-4.2 Criteria for Conformity**

If any casting of the castings selected (*see* A-4.1) for the radiographic examination fails, a further two percent of the castings from the same lot shall be selected and tested. If any one of them fails, the whole lot represented by the casting, shall be rejected.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'

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#### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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